THE TADPOLE OF *LITORIA SPENCERI* (ANURA:HYLIDAE)

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The tadpole of the endangered species, *Litoria spenceri*, has a dextral anus, a sinistral spiracle, two rows of teeth in the anterior labium and three rows of teeth in the posterior labium. These morphological features are identifying characteristics for most tadpoles of the genus *Litoria*. The diagnostic characteristics for tadpoles of *Litoria spenceri* include the uniform distribution of chromatophores and the wide oral disc. In East Gippsland, Victoria, tadpoles were found in a range of riparian microhabitats, however, the majority were found in the main streams or connected streamside pools.

LITORIA SPENCERI (Spencer, 1901) is a medium-sized tree frog (up to 60 mm), adult males range between 30 and 40 mm. Dorsal colour in life varies from dark brown to bright green, usually with a warty/spotted appearance. The ventral surface is white and granulated with a yellowish tint under the limbs. All specimens have been found adjacent to fast-flowing rocky streams both east and west of the Great Dividing Range. All known localities are within an altitudinal range between 280 and 1100 metres (Gillespie 1993). Frogs have been found between October and April, and calling males have been heard in October, November and early December (Hero 1990a, 1991; Watson et al. 1991; Gillespie 1993) and February (Gillespie, pers. obs). The seasonal distribution of size classes of frogs and breeding activity (Watson et al. 1991; Gillespie 1993) suggest that eggs are laid in late spring/early summer and tadpoles reach metamorphosis in late summer/autumn.

Historically, *L. spenceri* was known from 11 streams in north-eastern Victoria and at one locality in the Kosciusko region of New South Wales. During the 1980s the species disappeared from many of the localities in which it had previously been encountered. Despite intensive searching between 1989 and 1991, *L. spenceri* could only be located along two streams in Victoria, the Taponga and the Wongungarra Rivers (Watson et al. 1991). Recent surveys have relocated the species in six of the catchments in which it was previously known and along six additional streams (Ehmann et al. 1993; Gillespie 1992, 1993; Gillespie & Hollis, pers. comm.). Another historical record has also been found from the Australian Capital Territory (Osborne et al. 1994).

While *L. spenceri* is now known to be extant in 14 streams, it cannot be located in five streams from which it has previously been recorded, and declines in extent of distribution appear to have occurred along at least four of the other streams (Gillespie 1993; Gillespie & Hollis, pers. comm.). Many of the populations are small and geographically restricted. *Litoria spenceri* is listed as endangered in Australia (ANZECC 1991).

Herein, we present a brief diagnosis and description of the tadpole of *L. spenceri* and the habitats where they have been found in north-eastern Victoria.

METHODS

Tadpoles were collected between January 1990 and April 1994 from streams in north-eastern Victoria as part of intensive surveys for *L. spenceri* (Table 1, Fig. 1).

Tadpoles at two sites, the Wongungarra River and the Taponga River, were identified by growing them to metamorphosis. Tadpoles collected at other localities were identified following confirmation of the identifications at the former two sites. At each collection site, microhabitat was recorded and the presence of tadpoles of other species, as well as any fish, were noted. A brief description of the stream was also compiled. Observations of tadpoles and adults from other sites were also made.

Tadpoles were anaethetised with 1% sodium pentobarbital and preserved in 4% neutral formalin. Measurements were made with the aid of an ocular micrometer fitted to a dissecting microscope. Descriptions are based on living material

and drawings made from tracings of photographs taken using an Olympus JM-Tr dissecting microscope and an Olympus PM-6 photomicrographic camera. Drawings were made of a single representative specimen placed in the Museum of Victoria (NMV D66051).

Habitat and life history notes also are presented to assist identification in the field. These are intended only as a guide and tadpoles could be found in different habitats and months than those given. Caution should be taken with colour descriptions as tadpole colour is often a function of water clarity (Bragg 1957).

Terminology follows Altig (1970) and Hero (1990b) and development stages follow those described by Gosner (1960). For those specimens that have been placed in the Museum of Victoria, museum numbers are presented in Table 1.

Locality	Map and grid reference	Date	Museum of Victoria No.	Gosner stage	Body length (mm)	Total length (mm)	Width of oral disc (mm)	Water body
Big River (Eildon)	8123 205573	19.1.90		25				BW
Wongungarra River	8323 387424	20.2.90		42				CSP
Taponga River	8123 163632	16.2.91		25				FS
	8123 045895	23.2.92	D66048	42	11.6	24.7	*	FS
Goulburn River	8122 385473	21.2.92	D66049	36	12.3	28.1	3.9	FS
Big River	8324 346276	10.3.92	D66050	37	14.7	36.3	4.8	CSP
Mitta Mitta	8324 346276	10.3.92	D66050	38	15.3	36.5	5.0	CSP
	8324 346276	10.3.92	D66050	43	14.7	31.6	*	CSP
	8324 339292	5.3.92	D66051	36	14.9	35.7	4.4	CSP
	8324 339292	5.3.92	D66051	38	15.1	35.8	5.1	CSP
	8324 339292	5.3.92	D66051	38	15.2	36.7	5.2	CSP
	8324 339292	5.3.92	D66051	38	15.3	37.5	5.2	CSP
	8324 339292	5.3.92	D66051	42	14.0	30.5	3.8	CSP
Snowy Creek	8324 387424	12.3.92	D66052	43	15.3	20.7	*	FS
	8324 387424	12.3.92	D66052	46	16.4	16.4	*	PB
Still Creek	8123 040899	24.1.94		28	7.5	18.1	2.4	FS
	8123 040899	24.1.94		28	8.5	19.5	2.5	FS
Black River	8122 389470	25.1.94		37	14.3	31.7	4.0	ISP
	8122 389470	25.1.94		36	14.1	31.0	4.3	ISP
	8122 388468	25.1.94		33	11.7	25.8	3.3	FS
	8122 388468	25.1.94		36	15.8	32.2	4.5	FS
	8122 388468	25.1.94		32	10.5	24.4	3.5	FS
	8122 388468	25.1.94		35	13.3	30.3	4.2	FS
	8122 388468	25.1.94		36	15.8	34.4	4.5	FS
	8122 388468	25.1.94		36	14.3	33.4	4.4	FS
	8122 388468	25.1.94		35	13.9	31.4	4.6	FS
	8122 388468	25.1.94		34	12.1	26.6	3.6	FS
	8122 390467	25.1.94		37	14.9	36.1	4.7	FS
	8122 390467	25.1.94		36	15.0	32.5	4.8	FS
	8122 390467	25.1.94		35	13.9	30.1	4.5	FS
	8122 391465	25.1.94		36	14.6	32.6	4.5	CSP
	8122 391465	25.1.94		36	14.0	31.2	4.5	CSP
	8122 391465	25.1.94		35	12.4	28.1	4.2	CSP
	8122 391465	25.1.94		35	13.2	28.3	3.9	CSP
	8122 391465	25.1.94		35	15.6	32.7	4.7	CSP
	8122 391465	25.1.94		35	15.0	28.8	4.5	CSP
Bogong Creek	8525 126865	10.4.94	not collected	42	17.2	42.0	5.3	CSP

*Maiure tadpole with reduced oral disc.

Table 1. Localities and dates of collection, Museum of Victoria number (where available), microhabitat, Gosner stage and size of specimens examined in this study. Habitats are abbreviated as follows: CSP—connected stream side pool; BW—backwater of main stream; FS—flowing stream; ISP—isolated stream side pool; PB—pebble bank. Map and grid references are based on Australia 1:100 000 map series with the map number given before the six-digit grid reference.

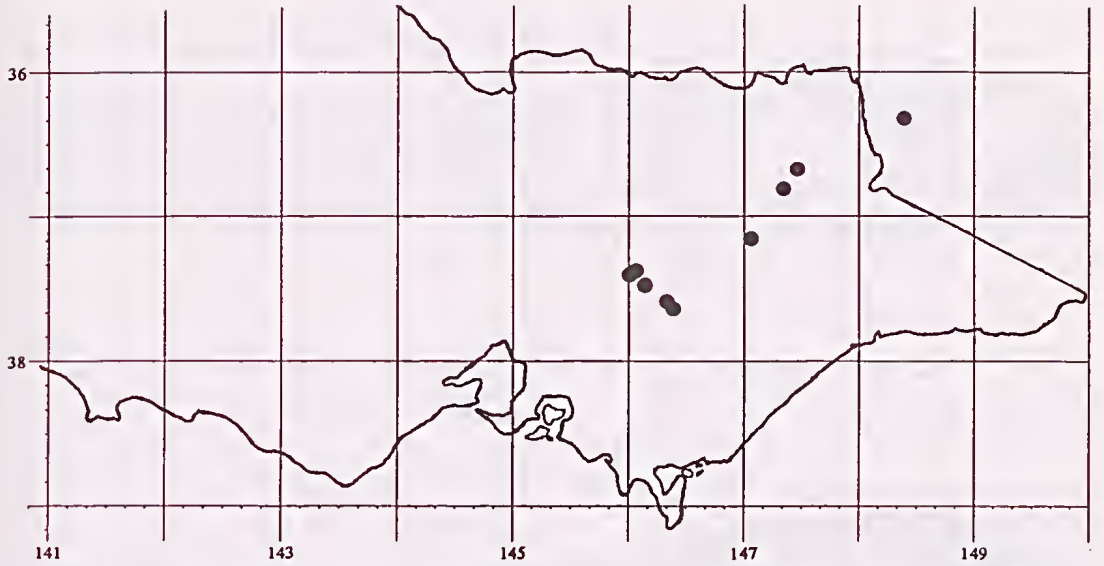

Fig. 1. Localities where tadpoles of *Litoria spenceri* were encountered in this study. (Source: Atlas of Victorian Wildlife.)

RESULTS AND DISCUSSION

Tadpole description (Fig. 2)

The anus is dextral and the spiracle sinistral. Eyes are dorsolateral. The oral disc is large; papillae have a wide anterior gap. There are two rows of labial teeth in the anterior labium and three in the posterior labium. Median gaps are present in the second anterior and the first posterior tooth rows, however, each side of the second anterior tooth row sometimes overlap at the midline as indicated in Fig. 2C.

The body is dark brown above with densely scattered fine silver and gold chromatophores that extend down the tall musculature and fins. Darkly pigmented, but discernible spots are scattered over the dorsum. The lateral body wall has a uniform dense scattering of fine silver chromatophores; the ventral body wall is transparent with scattered fine silver chromatophores extending onto the sides and covering the ventral surface. In life, the blood-filled heart and gills as well as coiled intestine are clearly visible through the ventral body wall. The tail fins are transparent with scattered melanophores; the tail is rounded to subacuminate. The body is streamlined with dorsolateral eyes more or less flush with body.

Measured tadpoles varied in length from 7.5 mm (Gosner stage 28) to 42 mm at Gosner stage 42 (Table 1). A newly metamorphosed juvenile had a body length of 16.4 mm (Table 1).

Calling males have been heard in October, November and early December. Tadpoles were observed between mid-January and early April and newly metamorphosed individuals have been recorded as early as the beginning of February. This suggests that tadpole development takes between two and four months during the summer months.

Habitat

Tadpoles of *L. spenceri* were found in a wide range of riparian microhabitats: connected streamside pools; backwaters in bedrock pools; directly in streams; and isolated streamside pools (Table 1). The majority of tadpoles were found directly in the main streams or connected stream side pools. Tadpoles were generally observed on the stream bed or along the water edge; grazing or resting on a range of substrates (rock, sand, leaf litter, algae and detritus, and amongst pebbles). Tadpoles were only located in an isolated stream side pool on one occasion (two individuals). This was a bed rock pool which may have become isolated after tadpoles had moved into it. Tadpoles generally occurred in relatively calm or still waters; however this may reflect a bias in sampling, which was predominantly by visual observation. Many tadpoles were located adjacent to rapid water and on one occasion swam into a swift channel to avoid capture.

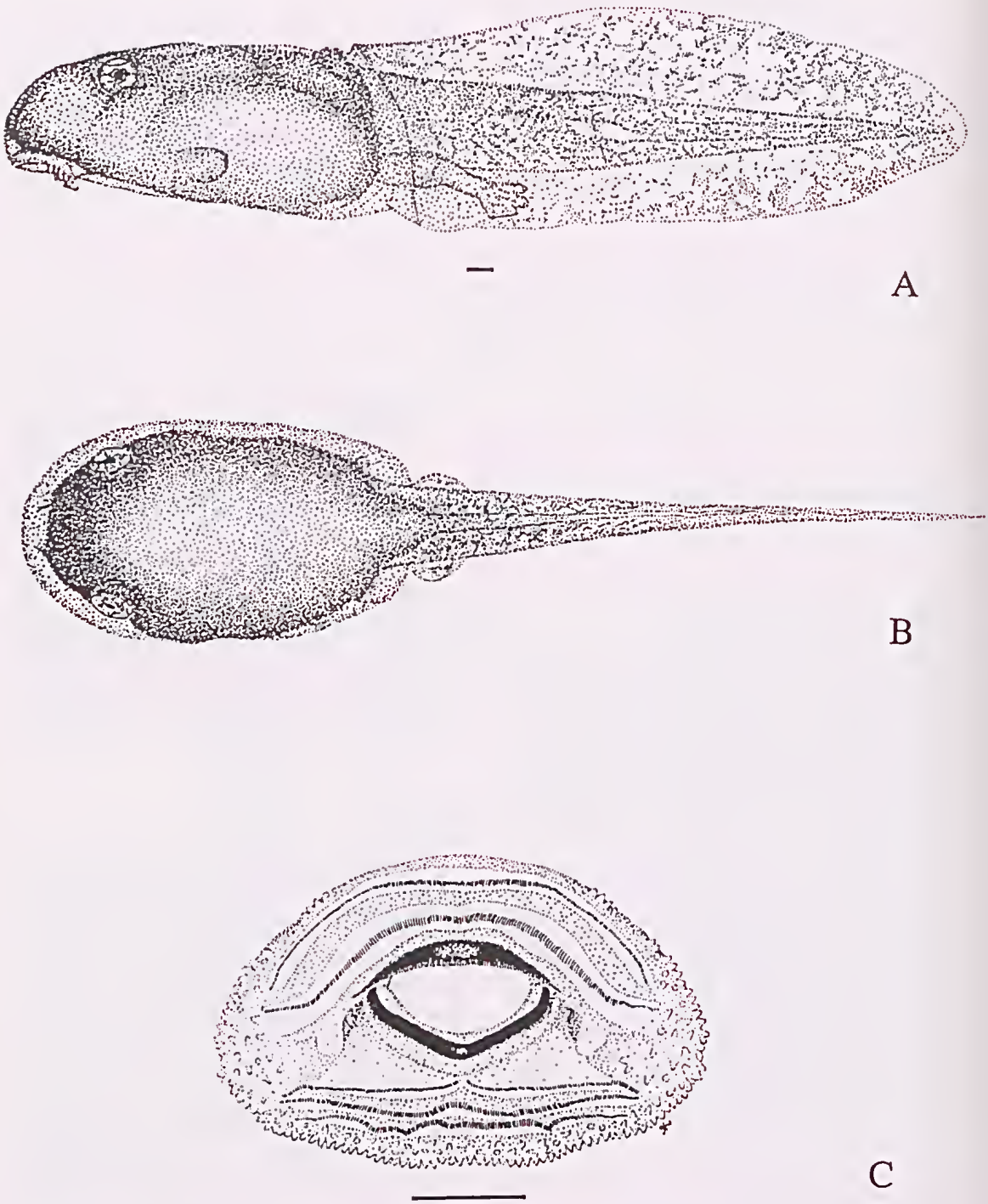

Fig. 2. Drawings from photographs of the tadpole of *Litoria spenceri*, Gosner stage 36 (NMV D66051) collected from the Big River (Mitta Mitta River) on 5 March 1992. Body length: 14.9 mm; total length: 35.7 mm; width of oral disc: 4.4 mm. A. Lateral view. B. Dorsal view. C. Oral disc. Solid bar represents 1 mm.

Two native fish species, the mountain galaxid (*Galaxias olidus*) and the river blackfish (*Gadopsis marmoratus*), and two exotic species, rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*) were often observed in the vicinity of tadpoles. This suggests that tadpoles of *L. spenceri* have defence mechanisms against fish predation. However, the effects of introduced trout species on tadpole survival are not known.

Sympatric species

Tadpoles of *L. spenceri* were found in sympatry with *L. lesueuri* on the Big and Taponga rivers, with *L. phyllochroa* and *L. lesueuri* on the Wongungarra River, with *L. phyllochroa* on Bogong Creek, and *L. lesueuri* and *L. ewingii* complex tadpoles in an isolated streamside pool on the Black River. *Litoria citropa* has been found in adjacent river systems but is not known to occur with *L. spenceri*. Hero & Gillespie (1993) have provided information on distinguishing these riverine tadpoles in the field.

The tadpole of *L. phyllochroa* is the most easily confused with that of *L. spenceri*. Superficially *L. spenceri* tadpoles are slightly more dorsoventrally compressed, with eyes more dorsally oriented than *L. phyllochroa*. The uniform distribution of chromataphores on the flanks of *L. spenceri* tadpoles generally contrasts with that of *L. phyllochroa*, which usually has clusters of gold and black chromataphores on the flanks which produce striations or blotches. However, the most reliable diagnostic characteristic is the oral disc which is wider in *L. spenceri* than *L. phyllochroa* (body length/oral disc ratio <3.8 versus >3.8 respectively; Hero & Gillespie 1993).

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